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Priority Claim 3-602

# Bescheinigung Certificate Attestation

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The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

**Patentanmeldung Nr. Patent application No. Demande de brevet n°**

00480118.9

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
p.o.

I.L.C. HATTEN-HECKMAN

DEN HAAG, DEN
THE HAGUE, 08/06/01
LA HAYE, LE

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# Blatt 2 der Bescheinigung
# Sheet 2 of the certificate
# Page 2 de l'attestation

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Application no.:
Demande n°: 00480118.9

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Anmelder:
Applicant(s):
Demandeur(s):
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UNITED STATES OF AMERICA

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Titre de l'invention:
Electronic board carrying connectors on each side of its lower edge.

In Anspruch genommene Priorität(en) / Priority(ies) claimed / Priorité(s) revendiquée(s)

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# ELECTRONIC BOARD CARRYING CONNECTORS ON EACH SIDE OF ITS LOWER EDGE

## Field of the Invention

The present invention relates to the connection of electronic boards in a housing and more particularly to an electronic board carrying connectors on each side of its lower edge to provide a high number of electrical contacts, that is adapted to withstand the strong forces required to insert or extract it in a housing.

## Background of the Invention

As printed circuit boards (PCBs) are well adapted for electrical system evolutivity and simplify the maintenance tasks, PCBs are a common form of electrical circuit packaging. Today, many electrical systems like computers, routers and

switchers are based on a housing containing a backplane comprising active devices or not and at least one slot to connect an electronic board. Electronic boards are linked to the backplane with connectors, located on the electronic board lower edge and backplane surface, through which signals are transmitted. These connectors are subjects to some electrical and mechanical requirements : signals must be transmitted efficiently, e.g. without deformation and at high speed. The electronic boards must be able to be inserted or extracted easily and must be retained so that electrical connections are not disturbed. Several techniques are used to couple connectors to electronic boards and backplane. Typically, the connector may comprise external pins that go through the board and are welded on the other side, it may be welded on the board surface, e.g. using component surface mounting technique, or it may be held in place with the use of external and flexible pins that go through the board but do not required to be welded on the other side. This last coupling system, referred to as press-fit, is commonly used since it reduces manufacturing cost.

The electronic packaging engineering practice is facing, since almost these 5 last years, a dramatic increase of the number of Input/Output (I/O) contacts (pins and sockets) which result in an increasing size of logic boards. The technology progress in the field of the Information Technology (IT) equipment and the electronics made the electronic boards a piece of technology by itself (matched impedance, Polytetraflouroethylene (PTFE) insulators, mechanical strength and geometry). The conjunction of these factors are making the mechanical packaging of these product/machine more costly from a development but also manufacturing stand point and, as a result, makes the installation and the removal of a logic board from the machine backplane a real problem.

As the number of electrical contacts increases, the force required to insert or extract an electronic board from a housing increases correspondingly.

Figure 1, showing a conventional backplane 100 equipped with a connector 110 and a large connector 115 mounted on an electronic board 105, illustrates the force 120 exerted to insert or extract the electronic board 105, that is not applied directly on the connector for practical reason, i.e. the connector is carried on the lower edge of the electronic board, but on the electronic board itself. Consequently, due to the connector width and the mechanical resistance of the electrical contacts, force 120 produces forces 125, 130 and 135 that lead to disunite connector 115 and electronic board 105. Furthermore, these forces, asymmetrically distributed upon the electronic board 105, may lead to damage the electronic board itself or the electronic devices welded on its surfaces. To overcome this risk, the force must be applied symmetrically on the electronic board and thus, electrical contacts must be distributed on each side of the electronic board lower edge. Obviously, connectors with pins that go through the electronic board, e.g. welded pin or press-fit connector, can not be used since it would lead to shorts between connectors.

Figure 2 illustrates the conventional way to use symmetrical surface mounted connectors. This coupling system allows to distribute the force on the two connectors 115'-1 and 115'-2 and thus reduces the risk of damaging the electronic board itself and the devices mounted on its surfaces. Likewise, by reference to Fig. 1, the smaller width of these connectors reduces the risk of disuniting connectors 115'-1/115'-2 and electronic board 105. Nevertheless, even if this connecting system prevents damaging the electronic board itself or the welded components, connector solders may break

due to the shearing forces since connectors 115'-1 and 115'-2 do not comprise any pin that strongly held them in place.

## Summary of the Invention

Thus, it is an object of the invention to provide an electronic board carrying connectors on each side of its lower edge to provide many electrical contacts.

It is another object of the invention to provide an electronic board carrying connectors on each side of its lower edge that can withstand the strong forces required to insert or extract a board in a housing.

It is a further object of the invention to provide an electronic board carrying connectors on each side of its lower edge adapted to insure a predefined distance between these two connectors.

The accomplishment of these and other related objects is achieved by an electronic board that comprises two elementary electronic boards, coupled together with the use of an adhesive insulative layer, each of said two elementary electronic boards carrying at least one connector on its external lower edge, said at least one connector comprising external pins that go through the elementary electronic board carrying said at least one connector.

Further advantages of the present invention will become apparent to the ones skilled in the art upon examination of the drawings and detailed description. It is intended that any additional advantages be incorporated herein.

## Brief Description of the Drawings

**Figure 1** shows a first conventional connecting system, comprising a large connector that includes many electrical contacts, mounted on an electronic board.

**Figure 2** describes a second conventional connecting system, comprising two connectors carried on the two lower sides of an electronic board, that include as many electrical contacts as the connector depicted on Fig. 1.

**Figure 3** , comprising figures 3a and 3b, illustrates the connecting system according to the invention consisting in coupling two symmetrical electronic boards, each carrying a connector.

**Figure 4** is a detailed view of the coupling system of the two electronic boards according to the invention.

**Figure 5** illustrates a first system to provide a predefined distance between the two connectors presented on Fig. 3.

**Figure 6** illustrates a second solution to provide a predefined distance between the two connectors presented on Fig. 3 that reduces electromagnetic emission on the electronic board lower edge.

## Detailed Description of the Preferred Embodiment

The preferred embodiment of the present invention is for use with electronic boards for routing or switching systems that require great numbers of electrical connections and high speed signal transmissions wherein press-fit connectors are used. Nevertheless, it is to be understood that the present

invention can be put in use with whatever kind of independent and removable electronic boards and with other kinds of connectors.

According to the invention, an electronic board is the result of the coupling of two symmetrical "classical" electronic boards, referred to as elementary electronic boards in the description for sake of clarity. To facilitate the coupling operation, electronic devices are preferably welded on only one surface of elementary electronic boards or embedded inside their thickness.

Figure 3a illustrates two elementary electronic boards 105-1 and 105-2 wherein connectors 115-1 and 115-2 are symmetrically disposed along the elementary electronic board external lower edges. To provide a good hooking between the elementary electronic board and the connectors, the connectors comprise pins that go through the elementary electronic board so that they are welded on the other side of the elementary electronic board or maintained by a flexible mechanism. As shown on figure 3b, the two elementary electronic boards are coupled together to form an electronic board that comprises symmetrical connectors carried on the lower edge. An adhesive insulative layer 300 is used to couple elementary electronic boards 105-1 and 105-2.

The communications between the two elementary electronic boards 105-1 and 105-2 are performed through electrical connections. These connections can be done either by vias or by conductive parts of the adhesive insulative layer 300. Figure 4 is an example of the elementary electronic boards coupling showing three electrical connections between the two elementary electronic boards 105-1 and 105-2. Elementary electronic boards 105-1 and 105-2 are coupled with the use of adhesive insulative layer 300 and comprise surface electronic devices 400 welded on their external surfaces. Electronic

devices 405 as resistances, capacitors and inductances, may also be embedded inside the elementary electronic boards. Elementary electronic boards may comprise several copper, or other conductive material, layers 410 used to carry electrical signals. Electrical contacts between these layers are done with micro-vias 415. Electrical signals can be transmitted from one elementary electronic board to the other either by via 420 or by conductive parts 425 of the adhesive insulative layer 300. When using vias, apertures are drilled in the electronic board after elementary electronic boards have been coupled, the vias are put in place using standard technique. The use of conductive parts in the adhesive insulative layer looks like the well-known use of adhesive layer for integrated circuit packaging. Using such technique, layer 300 can be use as an additional electronic board layer that can carries electrical signals.

Standard elementary multilayer electronic board making processes are not adapted to provided a constant and precise distance between the two surfaces of an electronic board. Using the invention wherein connectors may comprise many electrical connections and may require strong force to be inserted or extracted, this drawback may lead to damage the electrical contacts since the two female connectors 115-1 and 115-2 may be lightly out of alignment with the two corresponding male connectors coupled to the backplane. So, in a further embodiment of the invention, the adhesive insulative layer 300 is flexible to adjust the distance between the two connectors 115-1 and 115-2. The electrical contacts between the two elementary electronic boards is still done by vias or by conductive part of the adhesive insulative layer as described above. If the electrical contacts are done with conductive part of the adhesive insulative layer, these conductive parts must also be flexible, e.g. conductive elastomers or springy contacts. The distance between the two connectors 115-1 and 115-2 is set by mechanical means such as screws or rivets that

pass through the two elementary electronic boards 105-1 and 105-2. If the electrical contacts between the two elementary electronic boards 105-1 and 105-2 are performed by vias, the vias must be put in place after the distance between the two connectors 115-1 and 115-2 is set, e.g. in a pressing machine.

Figure 5 illustrates the backplane 100 comprising two male connectors 110-1 and 110-2 adapted to mate the two female connectors 115-1 and 115-2 carried by the two elementary electronic boards 105-1 and 105-2 respectively. As the distance d between the two connectors 110-1 and 110-2 is determined by the connector 110-1 and 110-2 pin piercing of the backplane 100, the distance of the connectors 115-1 and 115-2 must be exactly the same, i.e. equal to d. As mentioned above, standard electronic board making processes are not adapted to provide a constant and precise distance between the two surfaces of an electronic board. However, the use of a flexible adhesive insulative layer 300 allows to modify this distance after elementary electronic boards 105-1 and 105-2 have been coupled. To that end, apertures are drilled in the coupled electronic boards to receive mechanical maintaining means 500, e.g. screws or rivets, that are put in place after the distance has been set to its correct value d, e.g. in a pressing machine.

Figure 6 illustrates another locking mechanism to provide a precise distance between connectors 115-1 and 115-2. This mechanism consists in a U shape 600 that maintains the two elementary electronic boards 105-1 and 105-2. The base width of the U shape is equal to d. The upper parts of the U shape are inserted between the elementary electronic boards and the connectors thanks to cavities done in the elementary electronic boards. It is to be noticed that the base width of the U shape may be greater than d if the cavities are done in the connectors or in the elementary electronic boards and in the connectors. In a preferred embodiment, this U shape is

done in a conductive material and connected to the ground layers of the elementary electronic boards so that it reduces electromagnetic emission from the electronic board lower edge.

While the invention has been described in term of a preferred embodiment, those skilled in the art will recognize that the invention can be practice with other kind of removable boards, with other kind of connectors and with other devices to maintain the elementary boards coupled.

## Claims

**1.** An electronic board that comprises two elementary electronic boards (105-1 and 105-2), coupled together with the use of an adhesive insulative layer (300), each of said two elementary electronic boards (105-1 and 105-2) carrying at least one connector (115-1 and 115-2) on its external lower edge, said at least one connector (115-1 and 115-2) comprising external pins that go through the elementary electronic board (105-1 and 105-2) carrying said at least one connector (115-1 and 115-2).

**2.** The electronic board of claim 1 that further comprises at least one via (420) to transmit electrical signal from one of said elementary electronic boards (105-1 or 105-2) to the other (105-1 or 105-2).

**3.** The electronic board of either claim 1 or claim 2 wherein said adhesive insulative layer (300) comprises at least one conductive part (425).

**4.** The electronic board of anyone of claims 1 to 3 wherein said adhesive insulative layer (300) is flexible.

**5.** The electronic board of claim 4 that further comprises mechanical means (600) to maintain a predetermined distance between said connectors (115-1 and 115-2) carried by said two elementary electronic boards (105-1 or 105-2).

6. The electronic board of claim 5 wherein said mechanical means (600) to maintain a predetermined distance between said connectors (115-1 and 115-2) carried by said two elementary electronic boards (105-1 and 105-2) comprise a U shape localized at the lower edge of said electronic board (105-1 or 105-2), the upper parts of said U shape being inserted between said connectors (115-1 or 115-2) carried by said two elementary electronic boards (105-1 or 105-2) and said two elementary electronic boards (105-1 or 105-2).

7. The electronic board of claim 6 wherein said U shape is made with conductive material.

8. The electronic board of anyone of claims 1 to 7 wherein said at least one connector (115-1 and 115-2) of said two elementary electronic boards (105-1 and 105-2) is a press-fit connector.

# ELECTRONIC BOARD CARRYING CONNECTORS ON EACH SIDE OF ITS LOWER EDGE

**Abstract**

An electronic board carrying connectors (115-1 or 115-2) on each side of its lower edge adapted to withstand the strong forces required to insert or extract it in a housing and that provides many electrical contacts. The electronic board comprises two symmetrical standard electronic boards (105-1 or 105-2) coupled together, each carrying a connector (115-1 or 115-2) on its external lower edge. In a preferred embodiment, these two standard electronic boards (105-1 and 105-2) are coupled together thanks to a flexible adhesive insulative layer (300) and maintained by mechanical devices (600) such that the distance between these two connectors (115-1 or 115-2) is set to a predetermined distance. Still in a preferred embodiment, the mechanical device (600) used to maintain a predetermined distance between the two connectors (115-1 or 115-2) comprises a U shape, the upper part of this U shape being inserted between these connectors (115-1 or 115-2) and the standard electronic boards (105-1 or 105-2). The communication between these standard electronic boards (105-1 or 105-2) is performed with the use of vias (420) or by conductive parts (425) of the adhesive insulative layer (300).

Figure 3b.

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CENTOLA ET AL.
1/5

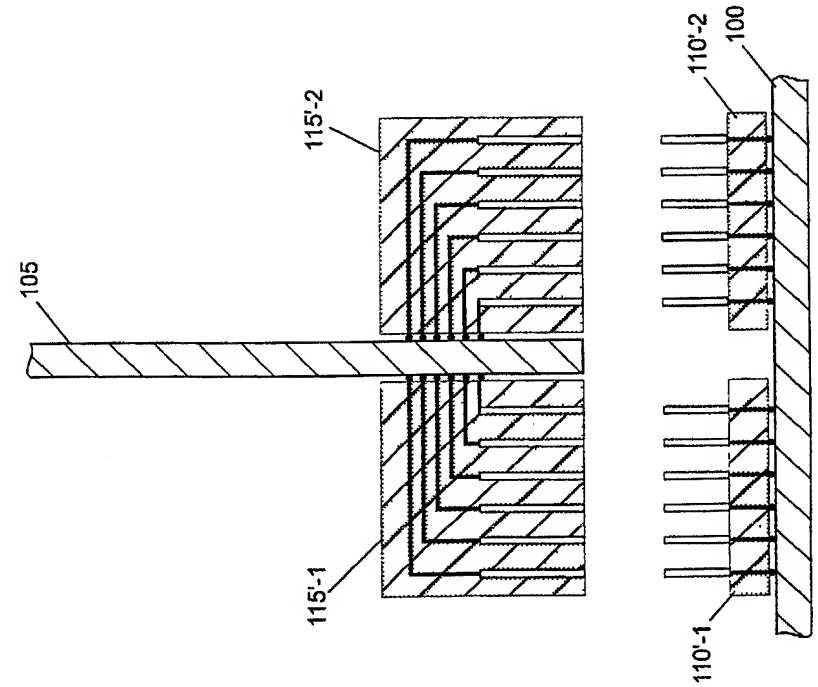


FIG. 2 (Prior Art)

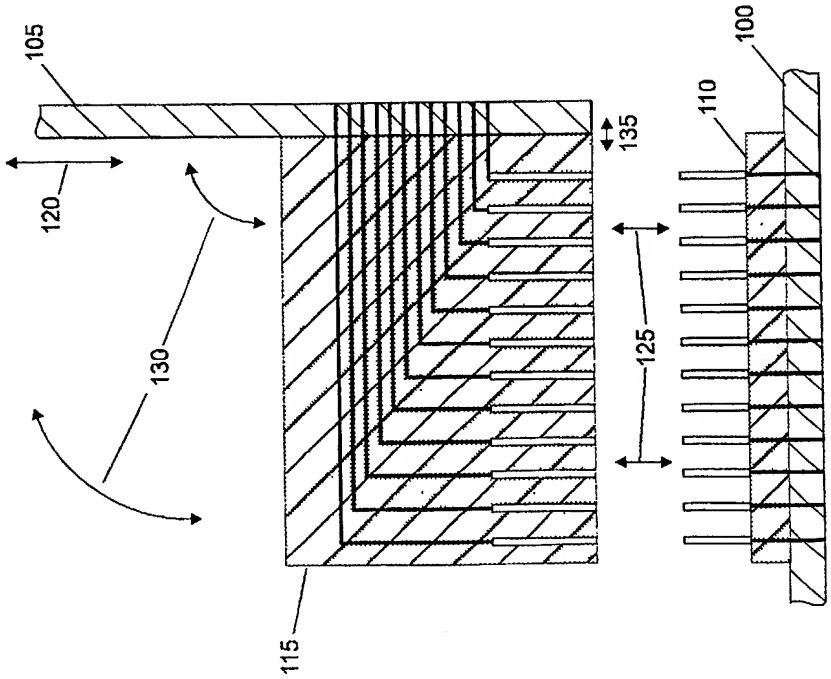


FIG. 1 (Prior Art)

FR9 2000 0047
CENTOLA ET AL.
2/5

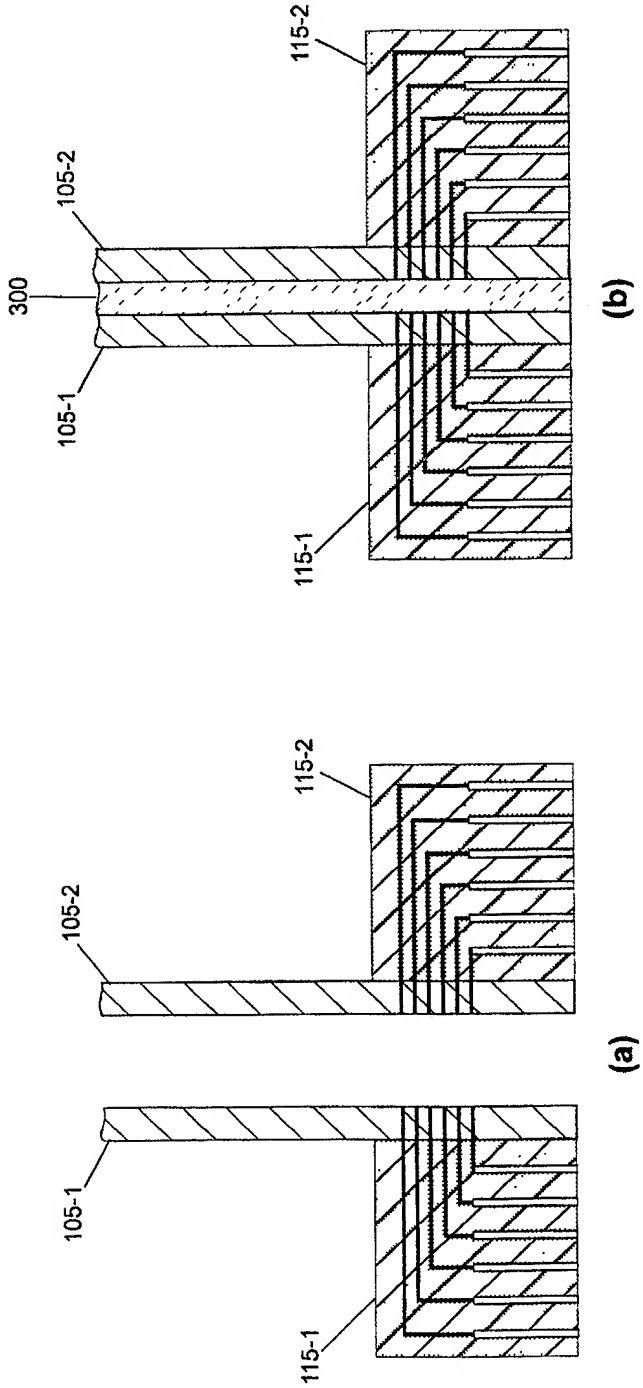


FIG. 3

FR9 2000 0047
CENTOLA ET AL.
3/5

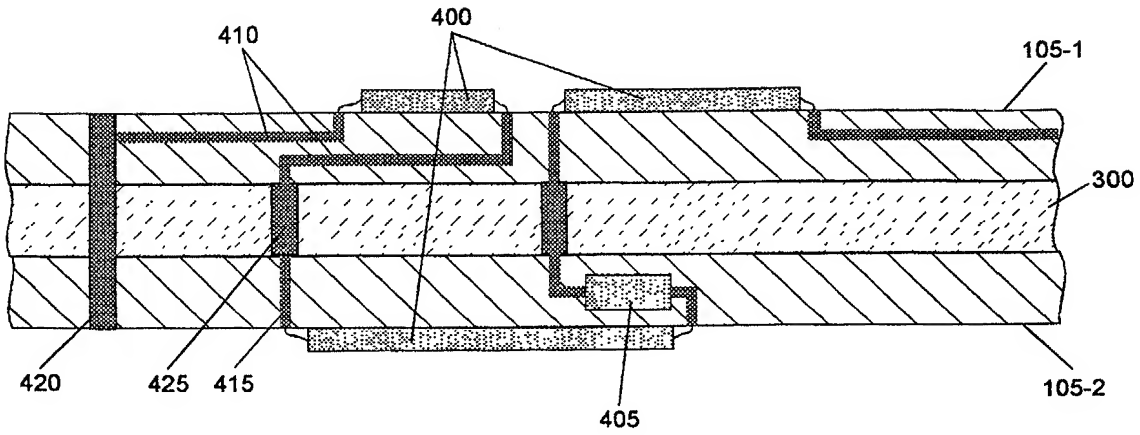


FIG. 4

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4/5

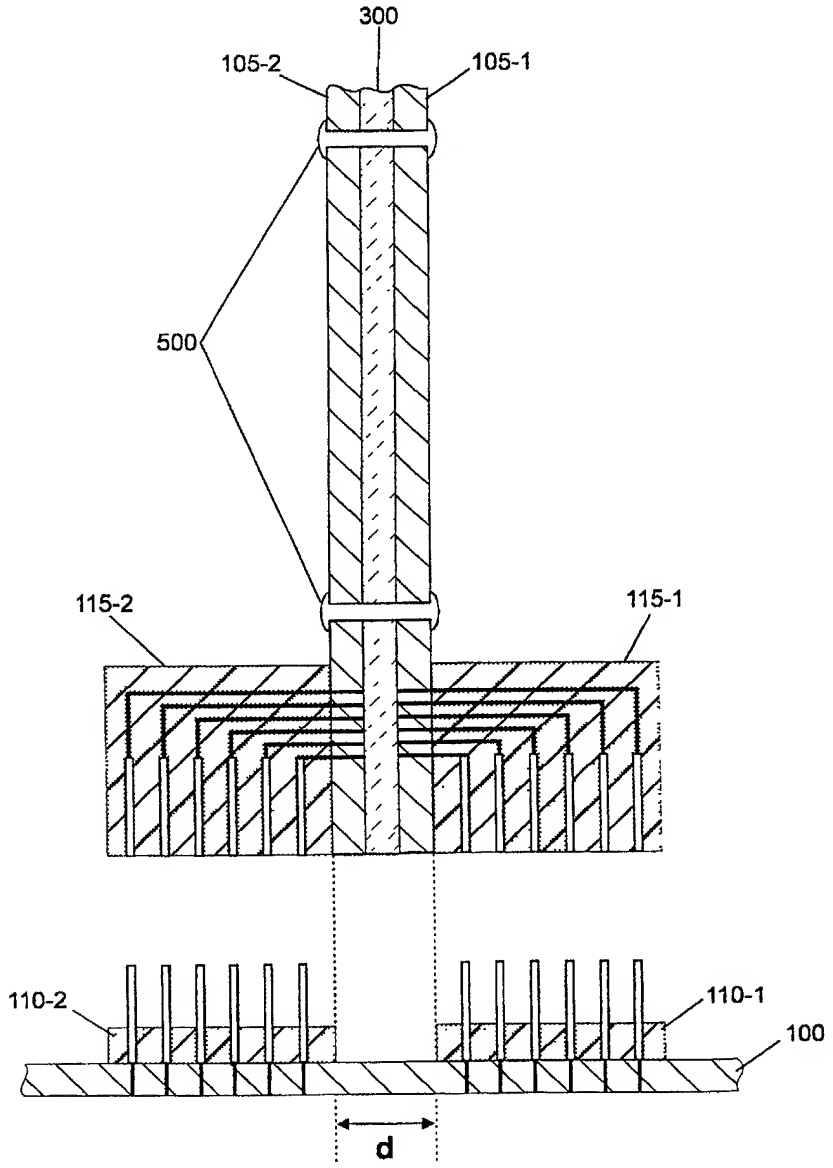


FIG. 5

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5/5

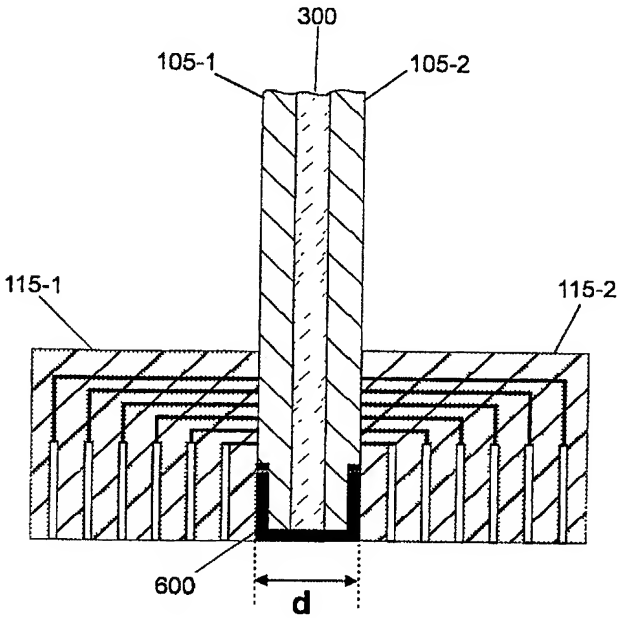


FIG. 6